U. **FISH CREEK**

(tributary to upper Cocolalla Creek)

***Summary:***
Fish Creek was placed on the 1996 303(d) list of water quality impaired streams for sediment and thermal modification. The 1996 Waterbody Assessment Guidance methodology using the 1994 Beneficial Use Reconnaissance Project data concluded that Fish Creek was fully supportive of all beneficial uses. Fish Creek was recommended for delisted based upon this data, however, remained on the 1998 303(d) list as impaired due to sediment, pathogen and thermal pollution. The 1996 methodology was later discounted, and in April 2000, removed from the water quality standards. We currently do not have an approved method of determining support status. Since the standards change, new data became available and it was determined that Fish Creek was impaired due to sediment and temperature. The target sediment load is 278 tons/yr, a 65 percent reduction over existing conditions. Temperature will not be addressed at this time pending an anticipated change to this standard. Limited data indicates that there is no impairment due to pathogens, however additional data should be collected to confirm this conclusion.

## 1. Physical and Biological Characteristics

Fish Creek drains into Cocolalla Creek ½ mile south of Cocolalla Lake at the junction of U.S. Highway 95 and the Fish Creek Road, 4 ½ miles north of Careywood, Bonner County, Idaho. The Fish Creek drainage contains 6,430 acres used primarily for forestry with small areas of rural residential. Land ownership is distributed among the Bureau of Land Management, Panhandle National Forest, the Idaho Department Lands, industrial timber companies, and small private owners.

The Fish Creek watershed is underlain in the western headwaters by Cretaceous plutons of granodiorite and diorite of the Kaniksu Batholith. Precambrian metasediments of various composition occur along the southeast side of the watershed. The lower elevations were affected by the Lake Missoula floods and exhibit scouring and mixed deposits.

Fish Creek is a third order tributary to Cocolalla Creek. The drainage is oriented in a easterly direction. It drains the west side of the Cocolalla watershed and is the second largest subwatershed within this drainage. Elevation ranges from 2,118 feet at the confluence to near 4,558 feet on Long Mountain.

Cool, dry summers and cold, wet winters characterize the area. Average annual precipitation is relatively low for north Idaho ranging from 25 inches at the lower elevations to 30 inches at the highest elevations. The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snow melt and major rain-on-snow events.

Vegetation varies with elevation, aspect and drainage. Lower elevations generally support Cedar-Hemlock habitat types. Uplands support a mixed conifer forest of Douglas fir, grand fir, red cedar, larch, hemlock, ponderosa pine, lodgepole pine, and western white pine, with the more xeric species dominating south to west facing aspects. Higher elevations include subalpine fir, spruce, alder, alpine meadows and brush fields. Very wet areas especially along riparian zones support alder, willow, and other water loving species.

Fish Creek consists of two main forks, a dendritic patterned south fork begins around elevation 4000 feet. For 2.7 stream miles the stream drops at an average 11% gradient to elevation 2486 feet where it meets with a north fork. The north fork is similar to the south fork in character and length. The soils in this upper drainage are highly erodible because of their granitic origin. There has been considerable silviculture activity over the years, particularly in the north fork sub-watershed. In most years the forks of Fish Creek are perennial, dominated by snow melt runoff (Rothrock 1995).

From the confluence of the south and north forks, Fish Creek Road parallels Fish Creek for 1.4 stream miles at a 3% gradient. The stream substrate is cobbles, gravel, and sand. Large amounts sediment enters the stream during storm events from this road surface and embankments. There also has been considerable residential development with private timber clearing and construction of access roads and driveways.

Fish Creek downstream from Cocolalla Loop Road has a gentle gradient where it passes through pasture land and approaches the southern end of the lake. The channel has been straightened in this stretch. At a point beginning 0.4 miles downstream from Cocolalla Loop Road, Fish Creek has become severely degraded. Upstream sediment runoff and bedload movement have settled and completely filled the stream channel. There also has been stream bank damage by cattle and horses. The result is a sediment delta which dams the creek and forces water to flow out over pasture land. A dendritic pattern of small channels flows north through the pasture and then converge into a main grassy waterway. This waterway enters Cocolalla Creek just upstream from the lake. The surrounding flatland east of lower Fish Creek is a combination of grazing land and wetland. Soil drainage is poor and in the spring there is considerable pooling of water.

## 2. Pollutant Source Inventory

<u>Point Source Discharges</u>
There are no known point sources of pollution discharging to Fish Creek.

<u>Nonpoint Source Discharges</u>
Fish Creek contributes 20% of the phosphorus load and 24% of the sediment entering Cocolalla Lake from tributaries. The upper Fish Creek watershed has had more logging activity over recent years than other areas throughout the Cocolalla Lake watershed. Sampling done in 1991 and 1992 show high peaks of total suspended solids and total phosphorus during storm events (FC1 sampling station). Samples comparing amounts of phosphorus from the headwaters versus downstream just above the pasture lands show an increase of 80% (Rothrock 1995).

## 2.a. Summary of Past and Present Pollution Control Efforts

Cocolalla Lake and its tributaries (including Fish Creek) have received considerable private and public attention over the last 20 years with efforts concentrated on reversing the eutrophication of the lake.

Cocolalla Lake is listed as a Special Resource Water under the Idaho Water Quality Standards and Wastewater Treatment Requirements. Cocolalla Lake and Cocolalla Creek were designated Stream Segments of Concern under the Idaho Antidegradation Program in 1990. After the Stream Segment of Concern designations, an Antidegradation Local Working Committee was formed which developed water quality objectives and site specific best management practices (BMPs) for forest land activities within the watershed. A Fish Creek Stream Assessment, sponsored by the Cocolalla Lake Association and the Idaho Division of Environmental Quality was conducted in 1995.

In light of the water quality problems in Cocolalla Lake, the Bonner Soil Conservation District made Cocolalla Lake a priority area and sought funding to develop corrective and preventative actions. The District received funding to develop a watershed management plan in late 1994. The resource inventory began in 1994 and continued through early summer of 1995. The funds to develop a management plan were granted to the District through the Idaho State Agricultural Water Quality Program (SAWQP). The SAWQP is administered by the IDEQ and the Idaho Soil Conservation Commission. The resource inventory includes an identification of the water quality problems, defining critical areas and development of a watershed management plan. The planning efforts were directed by a focus group. The focus group, comprised of ranchers, Cocolalla Lake Association members, and agency representatives met frequently to discuss previous and current findings related to the watershed.

A Phase 1 Diagnostic and Feasibility Analysis of Cocolalla Lake was performed by Glen Rothrock of the IDEQ in 1995 based upon water quality data collected from 1990 - 1992. In 1996, A Cocolalla Lake Watershed Management Plan was developed by Resource Planning Unlimited and the Bonner County Soil Conservation District.

## 3. Water Quality Concerns and Status

Fish Creek was listed for sediment, pathogens and thermal pollution in the 1994 305(b) Report. It was placed on the 1996 303(d) list for sediment and thermal pollution. In 1998 it remained on the 303(d) list with the addition of pathogen pollution. The presence of pathogens was checked in 1999 and determined not to be impairing the recreation beneficial use existing for this stream.

Fish Creek is also under scrutiny as a major tributary and consequently a pollutant supply to Cocolalla Lake. Particular pollutants of concern include nutrients, sediment, and thermal modification (high temperatures), all of which have been found to be impairing beneficial uses of Cocolalla Lake.

### 3.a. Applicable Water Quality Standards

Existing beneficial uses for Fish Creek include agricultural water supply, cold water biota and secondary contact recreation. The support status for salmonid spawning is undetermined. Fish Creek was listed as impaired due to sediment, pathogens and thermal modification. Idaho's water quality standard for sediment is narrative, and states that, "Sediment shall not exceed quantities...which impair designated beneficial uses." Standards protecting secondary contact recreation require that a single E.coli sample contain no more than 576 organisms/100 ml or no more than 126 organisms/100 ml based on a minimum of five samples taken every three to five days over a thirty day period. The temperature standard for salmonid spawning may also apply.

### 3.b. Summary and Analysis of Existing Water Quality Data

Water quality data was collected in 1991 and 1992 by the IDEQ as part of the Phase 1 Diagnostic and Feasibility Analysis for the Cocolalla Lake Watershed. This study was conducted to identify sources of pollution within the watershed. As part of this watershed, Fish Creek was evaluated for several water quality parameters at two stations along its length. These stations are identified in the literature as FC1 and FC2.

***1991 Stream Sampling Data***
The lower Fish Creek Station (FC2) was found to have a mean annual discharge of 8.5 cubic feet per second (cfs). There were two short duration high flows, one in February at 118 cfs and one in April reaching 150 cfs. The increase of water volume at FC2 over upper Fish Creek FC1 was 15% in 1991. Fish Creek was found to account for 20% of total Cocolalla Lake inflow (Rothrock 1995).

At lower Fish Creek a high peak phosphorus concentration (0.092 mg/L TP) was recorded on February 20th. This sample was associated with a heavy rain on snow event. This also coincided with an extreme peak value of TSS (65 mg/l). Other than single peak values, concentrations of phosphorus were within a range of 0.006-0.020 mg/L TP at both sites. Stream samples taken below the pasture area were three times higher than upstream values for both total phosphorus and dissolved orthophosphorus (Rothrock 1995).

Lower Fish Creek had a high TSS peak on the February 20th sample of 65 mg/L, while the peak at FC1 a day earlier was only 18 mg/L. Other than these extremes all of the TSS values but one were 4 mg/L or less at both stations (Rothrock 1995).

Bacteria counts taken at both of the Fish Creek stations were mostly low, except for a 190 fecal coliform organisms/100 ml at FC2 in early March. The two samples in July and August below the pasture flooding on lower Fish Creek had coliform counts averaging 500 fecal coliform/100 ml (Rothrock 1995). This was assumed to be related to a herd of horses which roamed freely through the pasture channels.

The highest temperature recorded in 1991 at FC2 was 13°C. Below the pasture flooding, Fish Creek temperature was 19°C. Continuous temperature measurements were collected on Fish Creek in 1997. Peak temperatures were recorded in early August at an average of 15°C for almost one week.

The low dissolved oxygen reading taken in 1991 at FC1 and FC2 was in August at 9.7 mg/L. Below the pasture flooding, there was a reading of 6.4 mg/L. The pH ranged between 6.5 to 7.5 units (Rothrock 1995).

***1992 Fish Creek Sampling Data***
Sampling results in 1992 began with a January rain-on-snow event. Sampling at FC2 showed that phosphorus levels climbed from 0.025 mg/l TP to 0.087 mg/l over a period of four days. Total suspended solids also climbed from 6 mg/l to 59 mg/l in the same time period. Upstream

at FC1 total suspended sediment samples from the north fork were 45 mg/l and from the south fork 21 mg/l. Sampling in February showed levels for both parameters back to their previous baseline values.

Samples were also taken downstream of station FC2 and the results compared to FC2. Total phosphorus and suspended sediment were both slightly greater than upstream of the pastureland (TSS by 2 mg/l and TP by 0.010 mg/l). This indicates that the braided section of stream bottom is a source of sediments and nutrients entering the lake. Peak discharge occurred in February at 30 cubic feet per second.

***Antidegradation Reconnaissance - Habitat, Macroinvertebrates, Fisheries.*** A reconnaissance level monitoring under the Antidegradation Program was undertaken in the summer of 1991 by IDEQ (IDHW-DEQ, 1991). Stream segments that were surveyed included lower Fish Creek. The reach sampled showed beneficial use impairment with unstable banks, pools and riffles sedimented, and substrate dominated sand and silt. Macroinvertebrates were dominated by black fly larvae, while mayflies and stoneflies were rare.

***BURP Data.*** Beneficial Use Reconnaissance data was collected 1994. Results of this investigation were a macrobiotic index of 4.69, a habitat index of 83, and a substrate consisting of 37.4% fines (particles <6mm diameter). This data was collected near the confluence of Fish and Cocolalla Creeks. One bacteria sample was taken in late July 1999 showing E. coli levels at 14 organisms per 100 ml, well below the 576 organisms/100 ml standard for secondary contact recreation.

***Cumulative Watershed Effects Data***
The Idaho Department of Lands conducted a Cumulative Watershed Effects analysis in this watershed in 1998. They found an adverse condition existed due to temperature by examining canopy cover. Channel stability rating was high due to bank sloughing, lack of vegetative bank protection and bank rock content, bank cutting, lack of large organic debris, and channel bottom movement. Surface erosion also received a high rating due to geological conditions (landtype associations #14, 50 and 51). The conclusion of the analysis was that site-specific best management practices must be developed for this watershed.

### 3.c. Data Gaps For Determination of Support Status

There has been no fish data recorded by the IDEQ for Fish Creek that could be used to determine support status of the salmonid spawning beneficial use in this watershed. Additional monitoring of bacteria in this stream would be valuable to more confidently determine the status of recreational uses.

## 4. Problem Assessment Conclusions

Stream channel instability and movement and bank and road erosion are causing excessive stream sedimentation. This sedimentation impairs cold water biota and contributes excessive amounts of nutrients to a lake impaired due to nutrients. Loss of canopy cover in the watershed is causing thermal pollution. Pending the outcome of the change to the state's temperature standard, this pollutant will be addressed at a later date. A TMDL for sediment is indicated by the above information and in support of the Cocolalla Lake TMDL.

## 5. TMDL

See attached spreadsheet.

### 5.a. Numeric Targets

See attached spreadsheet.

### 5.b. Source Analysis

See attached spreadsheet.

### 5.c. and 5.e. Monitoring Plan and Linkage Analysis

Because Idaho's Water Quality Standard for sediment is narrative and not based upon something directly measurable in the water column, a different approach is required to achieve a satisfactory monitoring plan. An analysis of the methods available for monitoring the success of TMDLs indicates that, in this case, more than one method should be used to verify the cause of the impairment, track load reduction, and to show that the stream is moving towards full support. The sediment monitoring plan will include three parts:

1. Determination of support status using Beneficial Use Reconnaissance monitoring. If the conclusion of the survey is no impairment for two surveys taken within a five-year time period then the stream can be considered restored to full support status.

2. Load reduction measures shall be tracked and quantified. For example, 1.2 miles of road obliteration near a stream, 0.5 miles of stream bank fenced, 5 acres of reforestation, etc.

3. Amount of sediment reduction achieved by implementation of load reduction measures shall be tracked on a yearly basis. For example, 1.2 miles of road obliteration will result in a 6 tons/yr reduction, 0.5 miles of stream bank fenced will result in a 3 ton/yr reduction, 5 acres of reforestation will result in a 0.7 ton/yr reduction, etc.

The reason for this three-part approach is the following:

1. DEQ presently uses the Beneficial Use Reconnaissance data to indicate if the stream is biologically impaired. Often times this impairment is based upon only one Reconnaissance survey. The survey should be repeated to insure that the impairment conclusion is correct and repeated twice after implementation to determine if the (improved) support status conclusion is correct. Survey data may

show impairment of fisheries or macroinvertebrate life and the cause of the impairment may point to sediment pollution. However, there is not a direct linkage between the pollutant and the impairment. Sediment could be indicated as the problem when, in fact, temperature might be the problem. The Reconnaissance data is not specific as to the cause, just that there is a problem. So using the Reconnaissance data alone to monitor the TMDL is not adequate.

2. There is great uncertainty about how much sediment actually needs to be reduced before beneficial uses are restored. These TMDLs use a very conservative approach, in that the sediment target is limited to natural background amounts. However, beneficial uses may be fully supported at some point before this target is achieved. Therefore, a measure of sediment reduction cannot be used exclusively to determine a return to full support.

3. Because TMDLs are based upon target loads measured in a mass per unit time there must be a method included to directly measure load reductions. Coefficients, which estimate sedimentation rates over time based upon land use, have been used to develop the existing loads. This same method can be used for land where erosion has been reduced. Road erosion rates are based upon the Cumulative Watershed Effects road scores. These scores can be updated as road improvements are made and the corresponding load reduction calculated.

## 5.d. Allocations

Load allocations are based upon land use as shown in the attached spreadsheet. Roads and stream banks are often the source of excess sediment.

## 5.f. Margin of Safety

Because the measure of sediment entering a stream throughout the entire watershed is a difficult and inexact science, assigning an arbitrary margin of safety would just add more error to the analysis. Instead, all assumptions made in the model have been the most conservative available. In this way, a margin of error was built into each step of the analysis. For an explanation of how the Cumulative Watershed Effects data was collected and processed, refer to the Idaho Department of Lands manual titled, "Forest Practices Cumulative Watershed Effects Process For Idaho". One important detail to note when looking at how the Cumulative Effects data was used in the TMDL is that, although all forest roads in the watershed were not assessed, the field crews are directed to assess the roads most likely to be contributing sediment to the stream. This weighted the average road scores towards the ones most likely to be in poor condition. Natural background is used as the target load, which is the most conservative assumption available.

## References

Gilmore, Shelly. 1996. Cocolalla Lake Watershed Management Plan. Bonner County Soil Conservation District. Sandpoint, Idaho.

Idaho Department of Health and Welfare, Division of Environmental Quality. 1991. Panhandle Basin Status Report. Boise, Idaho. 72pp.

Rothrock, G. 1995. Phase I Diagnostic and Feasibility Analysis Cocolalla Lake. Bonner County, Idaho, 1990-1992. Idaho Department of Health and Welfare, Division of Environmental Quality. Coeur d'Alene, Idaho.

**Fish Creek: Land Use Information**

| **Land Use** | | |
|---|---|---|
| Sub-watershed | Fish Creek | ***Explanation/Comments*** |
| Pasture (ac) | **429** | |
| Forest Land (ac) | **6,001** | |
| Unstocked Forest (ac) | **851** | Includes once burned areas |
| Highway (ac) | 0 | State or County Paved Highways |
| Double Fires (ac) | 0 | Areas which have been burned over twice |
| **Road Data** | | |
| Sub-Watershed | Fish Creek | |
| **1. Forest roads ( total miles)** | **39** | |
| CWE road score (av) | 21 | |
| *Sediment export coefficient (tons/mi/yr) | **5.1** | |
| #Total Forest Rd Failures (cubic yds delivered) | **0** | *Cumulative Watershed Effects Data* |
| **##2. Unpaved Co.& priv. roads ( total miles)** | 3.9 | |
| Paved Co.&priv. roads (total miles) | 0 | |
| Total C&P Rd Failures (cubic yds delivered) | 0 | *Based on weighted average of forest road failures.* |
| **###Stream bank erosion-both banks (mi)** | | ***erosion coefficients* |
| poor condition | **1.5** | *95 tons/yr/mi* |
| good condition | **3.0** | *47.5 tons/yr/mi* |

*McGreer et al. 1997
**Stevenson 1999. Good Condition: 5,280' X 2' high bank X 90lbs/ft3 X 0.1 ft/yr X 1ton/2000lbs = 47.5 tons/yr/mi
Poor Condition: 5,280' X 2' high bank X 90lbs/ft3 X 0.2 ft/yr X 1ton/2000lbs = 95 tons/yr/mi
#Total road failures are the amount of sediment observed by the CWE crews that was delivered to the stream. This amount is used to represent the yearly delivery to the stream. This is an over-estimate of sediment delivered to the stream since failures can continue to deliver sediment to the stream for a number of years after they occur, however, in a much reduced quantity. One must also take into consideration that all failures were not observed, which is an under-estimate of delivered sediment. These two factors combined with on-site verification by a

largest failures which probably occurred during the floods of 1996.
##County and private road erosion derived from using the same method as forest roads. Since the method used for foest roads is not designed for non-forest roads, the calculations will be revised if a better method can be found using the existing information.
###Source of data from DEQ 2000 bank inventory survey.

**Fish Creek: Sediment Yield**

***Explanation/Comments***

| Sediment Yield From Land Use | | |
|---|---|---|
| Watershed: | Fish Creek | *Acres by Land Use X Sediment Yield Coefficient = Tons Sediment/yr* |
| | | *Yield Coeff. (tons/ac/yr)* |
| Pasture (tons/yr) | 60.1 | *0.14* |
| Forest Land (tons/yr) | 228.0 | *0.038* |
| Unstocked Forest (tons/yr) | 14.5 | *0.017 (this acreage is a subset of Forest Land acreage)* |
| Highway (tons/yr) | 0 | *0.034* |
| Double Fires (tons/yr) | 0 | *0.017 (this acreage is a subset of Forest Land acreage)* |
| **Total Yield (tons/yr)** | **302.6** | *(Values taken from WATSED and RUSLE models see below explanation [#])* |

| *Sediment Yield From Roads | | |
|---|---|---|
| Watershed: | Fish Creek | |
| Forest Roads (tons/yr) | **198.9** | *Miles Forest Rd X Sediment Yield Coeff. from McGreer Model* |
| Forest Road Failure (tons/yr) | **0** | ***Assumes soil density of 1.7 g/cc and a conversion factor of 1.431.* |
| County and Private Roads (tons/yr) | **19.9** | |
| Co. and Private Road Failure (tons/yr) | 0 | |

*Percent fines and percent cobble of the Pend Oreille - Treble series B&C soil horizons is 80% fines, 20% cobble (Bonner Co. Soil Survey).
**"Guide for Interpreting Engineering Uses of Soils" USDA, Soil Conservation Service. Nov. 1971.
#Land use sediment yield coefficients sources: Pasture (0.14) obtained from RUSLE with the following inputs: Erosivity based on precipitation; soil erodibility based on soils in the watershed; average slope length and steepness by watershed; plant cover of a 10 yr pasture/hay rotation with intense harvesting and grazing; and no support practices in place to minimize erosion.
Forest Land (0.038) obtained from WATSED with the following inputs: landtype and size of watershed
Unstocked Forest (0.017) obtained from WATSED with the following inputs: Acreage of openings, landtype and years since harvest.
Highways (0.034) obtained from WATSED with the following inputs: Value obtained from the Coeur d'Alene Basin calculations.
Double Fires (0.017) obtained from WATSED with the following inputs: Acreage, years since fire and landtype.

**Fish Creek: Sediment Exported To Stream**

| | Fish Creek |
|---|---|
| Land use export (tons/yr) | 302.6 |
| Road export (tons/yr) | 218.8 |
| Road failure (tons/yr) | 0.0 |
| Bank export (tons/yr) | |
| poor condition | 142.5 |
| good condition | 142.5 |
| **Total export (tons/yr)** | **806.4** |
| *Natural Background Mass Failure (tons/yr) | 0 |

*Background mass failure is the difference between the total mass failure observed in the watershed, and the mass failure associated with roads.

**Fish Creek**

| | Acres | Yield Coefficient (tons/ac/yr) | | Background Load (tons/yr) |
|---|---|---|---|---|
| Total Watershed | 6,430 | | | |
| Presently Forested | 6,001 | | | |
| Estimated Historically Forested | 6,100 | 0.038 | | 231.8 |
| Estimated Historically Pasture | 330 | 0.14 | | 46.2 |
| Natural Mass Failure (tons/yr) | 0 | | | |
| Background Load = Target Load | | | **Target Load** | **278** |
| | | | **Existing Load** | **806.4** |
| | | | **Load Reduction** | **528.4** |